BAGHOUSE STANDARD OPERATING PROCEDURES MANUAL

FOR

COMPLIANCE WITH
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FROM
SECONDARY LEAD SMELTING

THE BATTERY RECYCLING COMPANY
ARECIBO, PUERTO RICO

JUNE 2011

CONTENTS

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

The Battery Recycling Company (BRC) owns and operates a lead recycling facility in Arecibo, Puerto Rico. The National Emission Standards for Hazardous Air Pollutants from Secondary Lead Smelting (40 CFR Part 63 Subpart X) or Maximum Achievable Control Technology (MACT) standard requires the preparation and implementation of a Standard Operating Procedures (SOP) Manual for baghouses that are used to control process, process fugitive, and fugitive dust sources. BRC uses two baghouses to control process emissions from two rotary furnaces and nine refining kettles and process fugitive emissions (slag and lead taps and molds during tapping).

The SOP addresses the elements required by the MACT standard, including:

- Baghouse inspection procedures
- Baghouse routine maintenance procedures, including a preventive maintenance schedule
- Bag leak detection system
- Corrective action plan

The SOP also addresses the handling of baghouse dust generated from the lead smelting operation.

1.2 PROCESS DESCRIPTION

Secondary lead smelting at BRC includes three major operations: scrap pretreatment, smelting, and refining.

Scrap pretreatment is the partial removal of metal and nonmetal contaminants from lead-bearing batteries. The batteries are initially placed in an inclined conveyor which brings the batteries into a mill to be crushed and separated. In this process, the mill removes the electrolytes from the batteries and transfers the fluid through multiple sets of settling tanks. After the last set of settling tanks, the electrolyte material is sent to the facility's wastewater treatment plant. The milling machine shreds the plastic battery housings and separates the remaining battery components in water by their densities. The separation process produces solid lead (cell plates), lead oxide, separators, and plastic. The battery milling system operates independently from the facility furnaces. The operations of the milling system depends on the amount of raw material (batteries) that are available for processing and the amount of lead and lead oxide that is stored.

Sufficient amounts of lead and lead oxide are stored to allow the facility to continue to operate its smelting process even during mill ruptures. Emissions from the furnaces operation is not affected by the operation of the mill. The battery crushing process is limited to the mill. Batteries are not broken or cut before being placed in the mill conveyor. The steel casing of the large industrial batteries is removed prior to placing such batteries in the conveyor. No lead dust is generated when the steel casing is removed.

Once dried, the lead-containing separated components are prepared to be fed to the rotary furnaces for smelting. Charge preparation is the process of loading the stored lead scrap and the other raw materials (soda ash, coal, lead, lead oxides, etc..) to the proper metallurgical requirements so it can be charged to the facility furnaces. Materials are loaded to a rotary steel hopper. BRC loads raw materials into the hopper using one of four tractor loaders that are available at the site. Materials are not loaded by hand. To minimize emissions during charge preparation and furnace loading, some of the following OSHA recommended measures are implemented:

- BRC provides vehicles with enclosed cabs that have positive pressure, HEPA-filtered air <u>or</u> employees using the loaders are always required to use full face OSHA approved respirators.
- Surfaces are kept wet and clean through the use of the water supply systems and vacuum cleaners.
- Vehicle speeds are reduced to minimize the dust activity.
- All surfaces have been repaved to facilitate housekeeping.

The rotary furnaces are fueled with used oil. Raw materials are charged into the furnaces using a rotary steel hopper which is charged into each furnace using a lift truck. Certain additives (soda ash, coal, etc.) are blended with the lead-containing components to achieve the desired properties of the product. Slag is removed from the furnaces, and the molten lead is then transferred to one of five identical kettles for further refining (adding various constituents to achieve desired product properties). During the refining process, waste dross is skimmed from the top of the kettles and removed for later use. After the refining process has been completed, the lead is shaped into ingots (either round or square, depending on the customer's specification).

BRC's operations do not include a blast furnace, dryer, or an agglomerating furnace; therefore, the requirements in the MACT standard related to these emission sources are not applicable.

Currently, the rotary furnaces, kettles, and process fugitive sources (lead taps and slag taps) are all exhausted to a common set of two eight-module baghouse units. A separate area was built for the ingot preparation. This area is equipped with a exhaust system that collects emissions to be sent to a baghouse. The baghouse systems exhaust through a common stack. The bags are cleaned by the shaker method. A particle detector is installed on the stack to help ensure proper operation of the baghouses.

2.0 OPERATING REQUIREMENTS

A baghouses is installed to control emissions from each rotary furnace, all kettles, and process fugitive sources (lead taps and molds, and slag taps and molds). The baghouses meet the following design parameters as per §63.543 and §63.544:

(1) Emissions are less than or equal to 2.0 milligrams of lead per dry standard cubic meter (0.00087 grains of lead per dry standard cubic foot).

(2) An annual compliance test for lead compounds is conducted.

(3) If the compliance test demonstrates a source emitted lead compounds at 1.0 milligram of lead per dry standard cubic feet (0.00044 grains of lead per dry standard cubic foot) or less during the time of the compliance test testing may be delayed to up to 24 calendar months.

(4) Process fugitive sources including the smelting furnace lead taps and molds during tapping and the smelting furnace slag taps and molds during tapping are equipped with an enclosure hood with a face velocity of at least 90 meters per minute (300 feet per minute) at all hood openings

(5) Process fugitive sources including the refining kettles are equipped with an enclosure hood with a face velocity of at least 75 meters per minute (250 feet per minute).

3.0 INSPECTION/MAINTENANCE PROCEDURES

The MACT standard identifies a number of specific requirements related to inspections and routine maintenance. As required by §63.548(c), the requirements that are relevant to BRC's facility include:

(1) Daily monitoring of pressure drop across each baghouse cell

(2) Weekly confirmation that dust is being removed from hoppers through visual inspection or an equivalent means of ensuring the proper functioning of the removal mechanisms

(3) An appropriate methodology for monitoring the cleaning cycles to ensure their proper operation

(4) Monthly check of bag cleaning mechanisms for proper functioning through visual inspection or equivalent means

(5) Monthly check of bag tension on shaker-type baghouses

(6) Quarterly confirmation of the physical integrity of the baghouse through visual inspection of the baghouse interior for air leaks

(7) Quarterly inspection of fans for wear, material buildup, and corrosion through visual inspection, vibration detectors, or equivalent means

(8) Continuous operation of a bag leak detection system

(9) Preventive maintenance schedule that is consistent with the baghouse manufacturer's instructions for routine and long-term maintenance.

Appendix 1 provides checklists for daily monitoring of pressure drop, and weekly, monthly, and quarterly inspections.

Bags are cleaned automatically when the pressure drop across the module exceeds preset values. There are eight modules in each of the baghouses; typically six are operating and up to two are in cleaning or maintenance mode. Pressure drop across each module, which is recorded daily, is used to determine if the bags are cleaned properly. Once per month the recorded pressure drops are reviewed to ensure that the bags are being properly cleaned.

Information and maintenance requirements for the bag leak detection systems is provided in Section 4.0 of this SOP.

The baghouse's preventive maintenance schedule is summarized on Table 1. Attachment 2 contains a log used to record routine maintenance on the unit. The maintenance log is not intended for daily observations.

TABLE 1
SUMMARY MAINTENANCE SCHEDULE FOR BAGHOUSE AND ASSOCIATED EQUIPMENT

	Maintenance Schedule					
Service Description	**Daily**	**Weekly**	**Monthly**	**Quarterly**	**Semi-annually**	**Annually**
Visually inspect unit.	X					
Check pressure drops on each module.	X					
Wipe-off leak detection probe.		X				
Grease bearings.[1]			X			
Check fan belts for wear; replace as needed. Check fan/motor alignment.			X			
Ensure dust removed from hoppers.		X				
Visual inspection of bag cleaning mechanism.			X			
Review pressure drop recordings.			X			
Visual check of bag tension.			X			
Conduct electronic drift test on leak detection system.			X			
Check baghouse for interior air leaks.				X		
Check furnace ductwork for air leaks.				X		
Check kettle ductwork for air leaks.				X		
Check settling chambers for air leaks.				X		
Check fan for excessive wear, material buildup, and corrosion.				X		
Tighten all fittings.					X	X
Replace bags.						X[2]
Bag leak detection system instrument set-up						X

[1] Depends on usage.
[2] Schedule may change based on bag manufacturer's recommendations.

4.0 BAG LEAK DETECTION

A bag leak detection system is required by §63.548. Each dust collector is equipped with a Triboguard bag leak detection system is installed in the combined duct from the baghouse modules. The Triboguard directly senses the motion of dry solids. An electrical charge transfer, between the particles and the sensor probe, produces the measured signal, which is known as the ***Triboelectric Effect***. The signal is amplified and conditioned by the Triboguard so as to provide a 0-100% bar graph indication and a 4-20mA output, both of which are directly related to the mass flow of solids over the sensor. All fabric filter bags allow some amount of PM to pass through; this constant bleed through is used to establish a baseline signal. When the signal reaches or exceeds a preset level (settable in 10% increments), the bar graph blinks to attract the operator's attention. The 4-20mA output is used for data collection and to initiate an alarm. Each system meets the following requirements of the MACT standard:

(1) The bag leak detection systems are certified by its manufacturer to be capable of detecting particulate matter emissions at concentrations of 10 milligrams per actual cubic meter (0.0044 grains per actual cubic foot) or less.

(2) The bag leak detection system sensors provide output of relative particulate matter loadings.

(3) The bag leak detection systems are equipped with an alarm system that will alarm when an increase in relative particulate loadings is detected over a preset level.

(4) Each bag leak detection system is installed and operated in a manner consistent with available written guidance from the U.S. Environmental Protection Agency or, in the absence of such written guidance, the manufacturer's written specifications and recommendations for installation, operation, and adjustment of the system.

(5) The initial adjustment of the systems, at a minimum, consists of establishing the baseline output by adjusting the sensitivity (range) and the averaging period of the device, and establishing the alarm set points and the alarm delay time.

(6) Following initial adjustment, BRC has not adjusted the sensitivity or range, averaging period, alarm set points, or alarm delay time, except as detailed in the approved SOP. In no event is the sensitivity increased by more than 100 percent or decreased more than 50 percent over a 365-day period unless such adjustment follows a complete baghouse inspection that demonstrates the baghouse is in good operating condition.

The sensitivity range, averaging period, alarm set points, and alarm delay time are adjusted by BRC in accordance with the manufacturer's recommendations.

4.1 Bag Leak Detection System Initial Set-Up Procedure

The following initial set-up procedures are recommended by the manufacturer of the equipment:

1. Remove the windowed cover for access to the controls

2. Set the **SENS** control to **10** and the **RESP TIME** control to **0.1** seconds.

3. Place the **X1 - X10** switch in the X10 position.

4. Ensure that power is applied to the unit and the green **POWER** LED is illuminated.

5. If the 4-20mA output is connected to a receiving device such as the PREVENT Alarm Relay Unit or a chart recorder, the yellow **CHECK 4-20 LED** ***should not be illuminated***. If the loop is not compliant or is disconnected, the yellow will illuminate; refer to **Chapter 6, Trouble Shooting** for assistance.

6. Set the **ALARM SET** switch to 100%.

4.2 Sensitivity and Response Time Adjustments

The sensitivity and response time adjustments are used to scale and characterize the analog outputs (0-100% bar graph and 4-20mA) of the instrument. The 0-100% bar graph and the 4-20rnA output directly correspond to each other. In other words, 0% equals 4mA and 100% equals 20mA.

The overall sensitivity setting, which is the product of the **X1 - X10** switch and the SENS control dial position, is factory set at maximum; a dial position of 10 (fully clockwise) and a switch position of X10 (high) (right position). The sensitivity adjustment is a linear adjustment that sets the instrument's span. For example: 0% always equals "No Flow" regardless of the sensitivity setting, while 100% (20mA) equals some amount of flow. The actual amount of flow, which corresponds to 100%, will vary with the sensitivity setting and must be set for each application. Assume that 100% equals 5 kg/h. Thus, decreasing the sensitivity increases the instrument's span (full scale value). In other words, for higher flow rates a lower sensitivity is needed, while for lower flow rates (such as dust emissions) a higher sensitivity is needed.

The following steps should be implemented when adjusting the sensitivity and response time of the instrument:

1. If a remote sensor is in use, ensure that the sensor and special able are properly installed and connected.

2. Ensure that the power and 4-20mA output are properly connected

3. Ensure that there is normal solids flow over the probe.

NOTE: No signal will be indicated if particles are not impacting the sensor probe.

4. If the TRIBOFLOW System is being used to monitor a dust collector, also ensure that the following conditions exist prior to making the sensitivity and response time adjustments:

  a. Upstream processes are functioning normally and the dust collector is collecting dust.

  b. Dust collector cleaning systems such as pulse jet, rapper or shaker cycles are also functioning properly, since they will cause momentary increases in dust emissions.

5. Ensure that the RESP TIME (smoothing) control is set to minimum. This is a one-turn control knob equipped with a calibrated scale of the approximate smoothing time constant.

6. If a dust collector such as a fabric filter (baghouse), cartridge filter, cyclone or precipitator is being monitored, use the following procedure. Otherwise, advance to Step 6.

  a. Select a sensitivity setting (**X1 - X10** switch and **SENS** control settings) such that the instrument output is averaging between approximately 10 and 20%. In some cases, such as after a highly efficient dust filter, it may not be possible to have an average signal as high at 10%. If so, operate the system at maximum sensitivity.

  b. Observe the output for several minutes with the response time (smoothing) at minimum. The bar graph display will usually be rather "active" and may even spike up to 100%, especially if a cleaning cycle occurs.

  c. To steady the display and the 4-20mA output, increase the response time slowing by turning the RESP TIME control clockwise a bit at a time.

  d. Continue making adjustments to the **SENS** and **RESP TIME** controls until the desired average signal of around 10-20% and desired short-term variations such as cleaning cycles can be observed on the display. It is often possible to detect small leaks and help locate leaks by monitoring the magnitude of the cleaning pulses. For this reason, the response time (smoothing) should be set long enough to prevent normal cleaning pulses from reaching high levels on the display, but not so long as to mask the cleaning pulses entirely.

  e. Place the **ALARM SET** switch in a position that will provide a visible alarm (blinking display) when an excessive particulate level is reached.

7. If other flow streams are being monitored such as an injection line, pneumatic conveying line or gravity feed stream, proceed as follows:.

Select a sensitivity setting (X1 - X10 switch and SENS control setting) such that the instrument output is averaging around 50%, . Adjust the response time (smoothing) to achieve the desired amount of short-term signal variation.

8. If possible, a flow increase or decrease should be initiated to check for proper operations.

4.3 Routine Maintenance

Routine maintenance should be provided using the following guidelines:

1. The electronics should be zeroed and the display calibrated once a year following the zero adjustment and display calibration procedures.

2. A system zero check should be performed at least once a year. This procedure is to ensure that noise sources have not been introduced so that any signal observed during normal operation is due to the flow conditions of the process.

3. The coaxial cable for remote sensors should be inspected for any physical damage and an electrical test should be conducted once a year following the coaxial cable electrical testing procedures.

4. The sensor probe and insulator should be checked periodically after installation to determine if, and at what intervals, cleaning is required. When monitoring a dust collector, the sensor should also be checked after a major filter break or other process upset. The conditions to look for when inspecting the probe are:

    a. Build up of material on the probe - Cleaning intervals should be such that a heavy build up of material is not permitted to form on the leading edge of the probe. Build up on the trailing edge is not a concern.

    b. Wet material, condensed liquids or conductive materials should not be permitted to build around the insulator. If these conditions are inherent in hour process, please consult the factory to insure you have the proper probe configuration.

5.0 CORRECTIVE ACTION PLAN

All fabric filter bags allow some amount of PM to pass through. This constant bleed through is used to establish a baseline signal. The baseline is set at the level in which the baghouse is operating normally. Periodic emission testing required under the applicable regulations ensure that the operation of the baghouse at normal levels complies with the standards. The leak detection system detects gradual or instantaneous increases in the signal from the baseline level. Triboelectric monitors are bag leak detectors, and are not meant to measure a mass emission rate nor are they designed to measure lead emissions. Accordingly, the triggering of an alarm indicates that an increase in relative particulate loadings is detected over a preset baseline level which is set at the control unit's normal operating level. In the event of an alarm on the bag leak detection system, BRC follows the procedures in this corrective action plan. BRC initiates the procedures to identify the cause of the alarm within 30 minutes. Appendix 2 contains a checklist that will be followed and completed in response to an alarm on the bag leak detection system. Appendix 3 is a Baghouse Malfunction Guide that includes some of the most common baghouse problems, their potential causes and corrective measures.

At a minimum, the bag leak detection system alarm is cleared by taking the necessary corrective actions, which may include:

- Inspecting the baghouse for air leaks, torn or broken filter elements, or any other malfunction that may cause an increase in emissions.
- Sealing off defective bags.
- Replacing defective bags or otherwise repairing the control device.
- Sealing off a defective baghouse compartment.
- Cleaning the bag leak detection system probe or otherwise repairing the bag leak detection system.
- Shutting down the process producing the particulate emissions.

6.0 BAGHOUSE DUST

The facility generates a dry emission control dust that is collected, stored and reused in the smelting furnaces. This dust is a listed hazardous waste pursuant to 40 C.F.R.§ 261.

The baghouse hoppers directly discharge the dust waste into open 187-gallon containers located at the dust bin building. Generally, the facility generates about 6 of these containers every day, but this amount can vary depending on the intensity of furnaces operation (e.g. maximum capacity).

An employee will monitor the container every 2 or 3 hours to verify when it gets full. The designated employee must ensure that excessive accumulation does not occur. Once full, each container will be carefully washed with an industrial water hose, and then will be covered with a resistant plastic wrap to minimize fugitive emissions. The area where the containers are placed, stored or handled between process steps will be washed to remove dust. The water from washing down the containers will go into a grid, then to a sump and will end in the water treatment plant to remove lead content.

Any spilled material will be promptly removed by shovel, broom, or other appropriate method.

A designated employee will take the covered container to the soda ash storage building where it will remain until reused and reintroduced into the furnaces along with raw material. The soda ash storage building is equipped with a steel security door that must remain closed at all times, except during unloading or transfer of the containers to the production building. Operators must ensure that doors are properly closed.

All employees handling baghouse dust must wear at all times personal protective equipment, including respiratory protection devices.

APPENDIX 1

INSPECTION AND MAINTENANCE FORMS

THE BATTERY RECYCLING COMPANY

DAILY BAGHOUSE INSPECTION LOG

MONTH:______________________ YEAR:________________________

Date	Pressure Drop*						Hour	Initials
	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

NOTE: Repairs performed as a result of anomalous log entries must be documented.
*Indicate cell(s) that are out of service or in a cleaning cycle.

THE BATTERY RECYCLING COMPANY

WEEKLY BAGHOUSE INSPECTION LOG

MONTH:____________________________ YEAR:_______________________

Week	Date, Initials	Visual Inspection – Dust Removed from Hoppers?
1		
2		
3		
4		
5		

MONTHLY BAGHOUSE INSPECTION/PM LOG

Employee Performing Monthly/Quarterly Check, Date:_______________________________________

Visual Inspection of Bag Cleaning Mechanisms – Operating Properly? Y / N

Is Monthly Pressure Differential Data for Module Increasing (circle Yes or No):

Yes, Module(s)______________________________ **No**

Bag Tension OK? ☐ Yes ☐ No

Bag Leak Detection System: ☐ Electronic Drift Check Performed

QUARTERLY BAGHOUSE INSPECTION (JAN, APR, JUL, OCT)

Visual Inspection – Any Interior Air Leaks?____

Visual Inspection – Indicate whether ductwork leaks were observed (circle Y or N):
Furnace to Header Y / N Kettles to Header Y / N Header to Baghouse Y / N

Inspection Type	Excessive Fan Wear?	Fan Material Build-up?	Fan Corrosion?
☐ Visual Inspection ☐ Vibration Detector ☐ Other:			

BAG CHANGEOUTS: Note the following:

- Current bag manufacturer: ____________________________________
- Recommended changeout schedule: ____________________________________
- Installation date of current bags in baghouse: ____________________________________

☐ **ANNUAL BAG LEAK DETECTION SYSTEM INSTRUMENT SET-UP**
(Procedure for setting alarm levels, sensor sensitivity, response time, etc. from manufacturer; ensure record of set-up is documented)

REPORT ANY FINDINGS TO THE PLANT MANAGER BY COMPLETING THE FIELDS BELOW:

Submitted to: __________________ Date Submitted:________________ Date Repaired:________________

NOTE: Repairs performed as a result of anomalous log entries must be documented.

THE BATTERY RECYCLING COMPANY

BAGHOUSE MAINTENANCE LOG

Date	Person Completing Work	Equipment Serviced	Work Performed

APPENDIX 2

BAG LEAK DETECTION SYSTEM ALARM CORRECTIVE ACTION PLAN FORM

THE BATTERY RECYCLING COMPANY

BAG LEAK DETECTION SYSTEM ALARM CORRECTIVE ACTION PLAN

For each bag leak detection system alarm, record the following information:

Date and Time of Alarm: ____

Time Procedures Below Initiated: ____
(Note: This time must less than 30 minutes after the time of the alarm)

Procedure (check the boxes upon completion until source of alarm is identified):

- ☐ Clean the bag leak detection probe.
- ☐ Determine which baghouse cell/module is the source of the bag leak detection alarm.
- ☐ Manually take the alarming baghouse cell/module offline.
- ☐ Inspect the alarming cell/module to determine the cause of the alarm:
    - If no bag has a leak, check the bag leak detection system for operational problems.
    - If a leaking bag is found, replace the bag.
    - If air leaks are found, keep the cell/module off-line until repairs can be made.
- ☐ If multiple bags from multiple modules are alarming, step through this procedure for each module.
    - If more than 2 modules are alarming, shutdown operations that exhaust to the baghouse until the appropriate repairs can be made.

Cause of Alarm: ____

____

Corrective Actions: ____

____

____

Are Revisions to Baghouse SOP Required?_____ If Yes, enter revision date:_____________

Date Form Completed: ____

Name of Person Completing Form:____

Signature: ____

THE BATTERY RECYCLING COMPANY

Appendix 3

Baghouse Malfunction Guide1		
Event	Potential Cause	Corrective Action
High baghouse pressure drop	• Bag cleaning mechanism not adjusting properly • Not capable of removing dust from bags • Excessive reentrainment of dust • Incorrect pressure reading	• Increase cleaning frequency • Clean longer duration • Clean out pressure taps • Check hoses for leaks. • Check diaphragm in gauge
Low baghouse pressure drop	• Filter bags ruptured • Fan speed too high • Ambient air infiltrating system	• Check for visible emission from stock • Check drives • Check all doors and hatches. Check system for leakage
Low baghouse pressure drop	• Induced draft fan failure • Restriction in duct before or after	• Check fan rotation, drives and speed. • Check all dampers • Check fan damper • Check for dust plugging ductwork.
Dust escaping at source	• Ducts leaking	• Patch leaks so air does not bypass source.
Discharge at stack	• Bags leaking • Bag not sealing • Failure of seals in joints at clean/dirty air connection. • Insufficient filter cake	• Check for proper bag installation • Caulk or weld seams • Allow more dust to build up on bags by cleaning less frequently. Use a precoating of dust on bags. • Check for holes or tears in bags. • Replace damaged bags. • Reseal bags as necessary.

1 This section on trouble shooting is provided as a guide for pinpointing in a short amount of time, some of the potential causes and problems associated with the baghouse.

The following charts list the most common problems, which may be found in a baghouse air pollution control system, and offers general solutions for the problems. In checking out any malfunction, the operator should first check out the obvious and simplest steps first. There are a number of instances in which the solution is to consult the manufacturer.